Application for a Permit for Scientific Purposes Under the Endangered Species Act of 1973 for Selected Waterways Within the City of Kent, Washington

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Prepared for:

National Marine Fisheries Service
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c/o Gary Rule
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CONTENTS

APPENDICES

A. TITLE

Application for Permit for Scientific Purposes under the Endangered Species Act of 1973 for selected waterways within the City of Kent, Washington.

B. SPECIES

Juvenile, threatened, Puget Sound ESU Chinook salmon (*Oncorhynchus tshawytscha*), if present in the study area, will be captured/handled during fyke netting, minnow trapping and/or electrofishing surveys and may be harassed during habitat/spawning surveys in the Green River watershed. Specifically, the Green/Duwamish River fall chinook stock may be impacted.

C. DATE OF APPLICATION

April 14, 2005

D. APPLICANT IDENTITY

R2 Resource Consultants, Inc.
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E. INFORMATION ON PERSONNEL, COOPERATORS, AND SPONSORS

1. Identity of applicant.

Principal Investigator: Dr. Dudley Reiser, R2 Resource Consultants, Inc. (see above address)
Field Supervisor: Mr. Eric Jeanes, R2 Resource Consultants, Inc. (see above address)
Field Supervisor: Ms. Catherine Morello, R2 Resource Consultants, Inc. (see above address)
Field Supervisor: Mr. Alan Olson, R2 Resource Consultants, Inc. (see above address)
Field Supervisor: Mr. Marcus Appy, R2 Resource Consultants, Inc. (see above address)

2. Identity of field personnel.

Mr. Michael Gagner, R2 Resource Consultants, Inc.
Mr. Timothy Nightengale, R2 Resource Consultants, Inc.
Mr. Adam Weybright, R2 Resource Consultants, Inc.
See attached resumes (Appendix A)

3. Identity of Cooperator and Sponsor.

Public Works Engineering
City of Kent, Washington 98032-5895
c/o Mr. Matt Knox (253) 856-5551), Mr. Mike Mactutis, Mr. Kelly Peterson

4. Identity of Contractor.

R2 Resource Consultants, Inc. will perform all field activities associated with this project. R2's office is located at 15250 N.E. 95th Street, Redmond, Washington 98052

5. Disposition of specimens.

If any expired specimens are recovered during sampling they will be turned over to an appropriate public educational collection facility (e.g., University of Washington Fish Collection, Seattle, Washington).

6. Transport and Long-term holding of listed species.

No live specimens will be transported or held long-term as part of this study.

F. PROJECT DESCRIPTION, PURPOSE, AND SIGNIFICANCE

1. Justification of the objectives.

This permit application is in regard to two separate but related studies to be performed by R2 Resource Consultants, Inc. for the City of Kent, Washington. The objective of both studies is to further the documentation of the presence/absence of juvenile salmonids in waters within the boundary of the City of Kent, Washington. Study 1 addresses the specific question of whether sub-yearling juvenile salmonids utilize the constructed habitat of the Green River Natural Resource Area (GRNRA) detention lagoon for overwintering, and if so for what time period are they present. Study 2 focuses on the identification of streams and waterways within the City that contain salmonids in an effort to aid in the implementation of the City of Kent's draft Critical Area's Ordinance. The identification of areas of salmonid use, including Chinook utilization, will allow for better planning and protection of these critical habitat areas by the City of Kent. The primary goal of this research is to identify waters containing anadromous salmonids within the City of Kent. Therefore it is necessary that the proposed sampling take place in areas of possible Chinook salmon habitat. If a Chinook salmon is observed in a particular stream or water body no further sampling will occur in that stream or water body, as presence will have been confirmed. In general, all sampling methods have the

potential to harm salmonids present in the study area. To the extent sampling conditions allow (e.g. water depth and clarity), R2 will utilize the least injurious sampling methods for completing the fish surveys. Thus, if possible (water clarity and depth) visual observations, i.e., snorkeling, will be performed prior to electroshocking. In addition, all electrofishing surveys will only be performed by trained and experienced field crews who will utilize electrofishing settings that will reduce potential jnjury to and mortality of salmonids.

Please refer to the attached study plans for further detail (Appendix B; Appendix C).

2. Statement of recommendation of requirement of Federal agency.

This study will help fulfill the City of Kent's permit requirements to the U.S. Army Corps of Engineers (ACOE). As part of ACOE permit No. 93-4-01513, the city of Kent was required to develop and implement a salmonid monitoring plan designed to enumerate juvenile coho salmon (*O. kisutch*) use of the created detention lagoon that is part of the Green River Natural Resource Area.

3. Statement of whether proposed project has broader significance than the individual's goals.

Results from this study and that of previous surveys will aid in determination of the present range and timing of threatened Puget Sound Chinook salmon within the Green River system.

4. Description of relationship or similarities to other projects.

The two studies are related in that both focus on determining the extent of salmonid use within streams and waters within the Kent City Limits. Study 1 pertains to the City of Kent's monitoring requirements for the GRNRA. Study 2 pertains to the City's desire to obtain and apply the most contemporary data relative to potential salmonid utilization when assessing Critical Areas Ordinance issues.

5. Justification for using listed species.

Similar studies conducted previously (see Appendices) did not capture any Chinook salmon during sampling. Possible encounters with Puget Sound Chinook during this study are anticipated to be limited. Upon the capture of any Chinook salmon, all survey activities in that location will be immediately halted. Alternative scenarios such as performing snorkeling surveys reduce the number of Chinook captured and handled to zero. However, physical conditions including water clarity, depth and instream cover in the study reaches prevent the use of snorkel observations.

G. PROJECT METHODOLOGY

1. Proposed project duration.

This study is proposed to start on 1 April 2005 and will continue through June 2006.

2. A detailed discussion of the procedures and research techniques used during the project.

a) Method(s) of capture and release.

Electrofishing is an active capture method that is expected to have the highest likelihood of success if salmonids are present in the project area. R2 Resource Consultants proposes to use two types of electrofishing set-ups: barge-based and backpack. The barge-based system will be used during Study 1, in the Green River detention lagoon. The general system that will be used consists of a Coffelt VVP-15 electrofisher unit mounted in a 12-foot fiberglass Coleman Crawdad and powered by a 5000 W, 240-Volt AC gasoline-powered generator. The electrofisher will be operated in a straight DC configuration with setting consistent with guidelines established by the WDFW (WDFW 1998). A mobile electrode system (Vincent 1971) using two 30 cm stainless steel balls suspended from booms as cathodes and a 24 cm aluminum anode attached to an electrical cable will be used to produce straight DC voltages and electrotaxis. Two anodes may be used to increase overall coverage. Each anode includes 15 feet of insulated cable for either hand-held passes or tossing and retrieval of the anode. An electrically isolated live car will be carried in the barge. Three trained biologists will operate the barge-based system.

A Smith-Root, Inc. Model 15-C programmable wave output backpack electrofishing unit will be used to conduct electrofishing surveys in Study 2, and sites less then 0.9m (3 ft) maximum depth for Study 1. A block net will be installed at both ends of the survey reaches. Electrofishing will begin at the lower site boundary and continue upstream to the block net. One transect measuring approximately 100 feet will be electrofished at each electrofishing survey site. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act (NMFS 1998) will be strictly adhered to during the field season.

Depending on flow conditions a fyke net may be used to monitor fish migration in the GRNRA. R2 Resource Consultants proposes to deploy the fyke net just north of the location where twin 9-foot culverts deliver water to the lagoon. All salmonids that might be diverted from Mill Creek would pass through these culverts, except those that travel upstream through the outflow channel. This location is strategic for capturing fish passing

through the culverts or traveling north or south along the eastern edge of the lagoon. The fyke net proposed for use has a 4 by 4 foot frame with 24-foot wings constructed of three-mm nylon mesh. The mouth of the net funnels down to a 1 foot throat containing three velocity shelters and empties into a 2 ft. wide, 2 ft. deep, 4 ft. long floating live car also constructed of 3 mm nylon mesh. The fyke net will be monitored and collected fish removed as often as practical from the live car. The net will be deployed and monitored for five consecutive days.

Supplemental sampling may also be performed using Gee Type minnow traps (mesh 0.25 inch) baited with commercial salmon eggs or other bait products. Two strings of 5 traps connected at about 20-foot intervals to a weighted line will be deployed in shallow water near shoreline cover or large woody debris. If utilized, the minnow traps will be checked and the fish processed (identified and measured) daily.

All fish will be captured with a dip net and placed into a darkened recovery unit where they will be anesthetized with tricaine methanesulfonate (70 mg/l), identified to species and measured to the nearest mm total length. Fish will then be allowed to recover in fresh water and will be released within the survey site that they were captured.

b) Description of any tags, including the method, location and duration of tag attachment.

This study does not employ the use of tags.

c) Description of type and dosage of any drugs to be used, purpose of use, and method of application.

In order to reduce the effects of handling stress, all fish will be anesthetized with tricaine methanesulfonate (70mg/l).

d) Temporary holding time prior to release of animal.

After processing, fish will be allowed to recover in fresh water and will be released within the survey site that they were captured.

e) Number and type of samples to be taken.

Fish will be identified to species and measured to the nearest mm total/fork length. Presence of any external tags or markings will be noted.

3. *Potential for injury or mortality to the animals involved, steps to minimize adverse effects and to ensure that animals will be taken in a humane manner.*

Injuries to juvenile salmonids will be reduced by several methods. Electrofishing current is supplied by using two hand-held wands as the anode and cathode, instead of the traditional format of a hand-held wand anode, and a "rat-tail" cathode (see Nielsen 1998). Juvenile fish captured using this technique are exposed to a brief electrical current before they are captured in the dip net. The areas to be sampled in this study are small, slower moving waters that require briefer periods of electrical current, and hence enable quicker fish capture. Stress, rather than shocking, has been correlated to the reduced survival of juvenile salmonids exposed to electrofishing (Nielsen 1998). Handling of the fish processed as part of this research will be minimized. Only experience individuals properly trained in the use of electrofishing equipment will perform the surveys. R2 personnel have several years of experience electrofishing for juvenile salmonids in the middle Green River, with low injury/mortality rates (Jeanes and Hilgert 2000). "Smooth" DC current at voltages of less than 400 has proven effective in the waters of the middle Green River, and will be used in this study.

H. DESCRIPTION AND ESTIMATES OF TAKE

1. *Listing of species and population to be taken.*

Sampling will include the Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) ESU, specifically the Green/Duwamish River fall Chinook stock.

2. *Sampling locations and dates.*

Study 1 will take place in the Green River Natural Resources Area, near the City of Kent, Washington. This study will occur over two five-day periods during March and late May/early June of 2005 and again during March and possible late May/early June of 2006. Study 2 will cover numerous streams and waterways within the City of Kent during March and April of 2005. Fall spawning surveys will also be performed. See attached study plans for a complete table of specific locations and project dates.

3. *Description of the recent status and trends of each species and/or population to be taken.*

Chinook salmon are present in the Green River from its mouth (Duwamish River) upstream to River Mile 61 (Tacoma Water Headworks). This Green-Duwamish River stock is considered healthy by WDFW (WDFW et al. 1994). The National Marine Fisheries Service (Myers et al. 1998) has placed Green River Chinook salmon, along with 28 other stocks, into the Puget Sound Evolutionarily Significant Unit (ESU). The Puget

Sound ESU encompasses all Chinook populations from the Elwha River on the Olympic Peninsula to the Nooksack River in North Puget Sound and south to the Nisqually River. The five-year mean natural escapement (1992-1996) for the Puget Sound ESU is approximately 27,000 spawners; recent total escapement (natural and hatchery fish) has averaged 74,000 Chinook (Myers et al. 1998). Total escapement in the mainstem Green River averaged 7,600 from 1987 through 1992 (WDFW et al. 1994), exceeding the escapement goal for all naturally spawned Chinook in the Green/Duwamish River of 5,800 (WDFW et al. 1994). Recent (1996-present) escapement levels have exceeded natural escapement goals for the Green River.

4. *Level of take.*

Take is estimated to be limited to capture and handling of juvenile (age-0+ and age-1+) Chinook salmon, including both male and female fish. Capture and handling may potentially result in injury or mortality of listed juvenile Chinook salmon although care will be taken during all surveys to reduce or prevent injury to all fish captured. The level of take anticipated for each of the two studies is noted in Table 1. For these studies, take would generally consist of the physical capture and release of the fish, without incurring actual injury or mortality. It is possible there may be both natural and hatchery Chinook within the area, so separate (but the same) take levels apply to each.

With respect to hatchery Chinook, 300,000 yearling, and 3.2 million sub-yearling Chinook are planned for release in May of this year from Soos Creek hatchery alone. A few hundred thousand are also generally released above HHD in March and possibly into other creeks (Seiler et al. 2004). The majority of the releases are adipose fin-clipped.

5. *Estimates of potential annual mortalities by take category, including justifications.*

Historical survey evidence (see Appendices) suggests the presence of threatened Chinook salmon in the study areas to be quite low. There is however, a small possibility of encountering juvenile Chinook salmon. All electrofishing activities will cease for a location if a Chinook is captured. Strict adherence to electrofishing guidelines and the use of trained and experienced individuals will further reduce the possibility of Chinook mortality. No mortalities from the deployment of the fyke net or minnow traps, passive capture techniques, are expected. All mortalities will be unintentional.

Overall, we estimate that annual mortalities of both natural and hatchery origin Chinook resulting from the two studies would be less than 2%. We are therefore requesting coverage for incidental mortality of juvenile Chinook salmon as described below.

- Application of the 2% mortality estimate to Study 1 – GRNRA, results in an annual mortality estimate of 0.1 fish (5 fish x 2% mortality) of both natural (assumes 5 fish take) and hatchery (assumes 5 fish take) origin. We rounded this number up to 1 juvenile Chinook of natural origin and 1 juvenile Chinook of hatchery origin per year.

- Application of this mortality estimate to Study 2 – Tributaries to Green River within City of Kent results in an annual mortality estimate of 0.5 fish (10 fish x 2% mortality) of both natural (assumes 5 fish take) and hatchery (assumes 5 fish take) origin. We rounded this number up to 1 juvenile Chinook of natural origin and 1 juvenile Chinook of hatchery origin per year.

The combined (both studies) estimate of annual mortality resulting from the requested sampling activities is 2 juvenile Chinook of natural origin, and 2 juvenile Chinook of hatchery origin. We are therefore requesting coverage for this incidental mortality as part of this permit.

6. *Derivation of take estimates.*

All take approximations are educated estimates based on historical sampling of the project area by other researchers (see Appendices), and related sampling performed by R2 Resource Consultants in previous years in the middle Green River.

I. TRANSPORTATION AND HOLDING

No live individuals will be transported from the capture site; all captured species will be released within 100 feet of their capture location. No individuals will be held for extended periods. All anesthetized individuals will be released after a recovery period in fresh water.

J. COOPERATIVE BREEDING PROGRAM

R2 Resource Consultants is willing to participate in a cooperative breeding program and to maintain or contribute data to a breeding program, if such action is requested. However, upon project completion, all data collected will be property of the City of Kent, Washington and will be released only at their discretion.

K. PREVIOUS OR CONCURRENT ACTIVITES INVOLVING LISTED SPECIES

1. Identification of pervious permits to work with federally listed species.
U.S. Fish and Wildlife permit No. TE005113-3 covering bull trout (*Salvelinus confluentus*) under Section 10(a)(1)(A) of the Endangered Species Act. Effective date 6 September 2002, expiring 8 May 2006. This permit was issued for work on Boundary Reservoir, Ross Lake and tributaries, Baker River basin from the mouth to headwaters, Lake Shannon, Baker Lake and Middle Skagit River. Principle officer is Dr. Dudley Reiser. Other authorized individuals include Eric Jeanes, Catherine Morello, Marcus Appy, and Adam Weybright.

2. Mortality events of listed species in the last five years.
Overall, over 150 native char have been tagged and released by R2 personnel under the above permits. One of these fish was injured during hook and line surveys in the Baker River basin. The fish was released alive, it is not known whether the injury was fatal. No immediate mortalities have occurred during work under the above permit. Hook and line surveys are performed with single barbless hooks in order to minimize adverse impacts.

L. CERTIFICATION

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand this information is submitted for the purpose of obtaining a permit under the Endangered Species Act of 1973 (ESA) and regulations promulgated thereunder, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or to penalties under the ESA."

_____ _____

Signature Date

Dr. Dudley Reiser
Senior Fisheries Biologist

I. REFERENCES

Jeanes, E. D. and P. J. Hilgert. Juvenile salmonid use of lateral stream habitats middle Green River, Washington. 1999 Data Report. Prepared for the U.S. Army Corps of Engineers, Settle District, and City of Tacoma Public Utilities, Tacoma Water by R2 Rsource Consultants, Inc.

Myers, J. M., R. G. Kope, G. J. Bryant, D. Teel, L. J. Lierheimer, T. C. Wainwright, W. S. Grant, F. W. Waknitz, K. Neely, S. T. Lindley and R. S. Waples. 1998. Status review of chinook salmon from Washington, Idaho, Oregon, and California. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-35.

National Marine Fisheries Service (NMFS). 1998. Suggested protocol for the use of backpack electrofishing equipment in waters containing fish listed under the Endangered Species Act (ESA). Portland, Oregon.

Neilsen, J. L. 1998. Electrofishing California's endangered fish populations. Fisheries 23(12):6-12

Vincent, R. 1971. River electrofishing and fish population estimates. Progressive Fish-Culturist 33: 163-169

Washington Dept. of Fish and Wildlife and Western Washington Treaty Tribes. 1994. 1992 Washington State salmon and steelhead stock inventory.

Table 1. Anticipated Annual Take by R2 Resource Consultants, Inc. within the Green River Natural Resource Area (Study 1) and selected tributaries to the Green River, Washington (Study 2) for the 2005/2006 field season.

Study #	Location	Sampling Dates	Potential ESA Species Found	Estimated Annual Take: Number of individuals by origin	Lifestage	Take Activity
1	Green River Natural Resource Area	2 sample dates: - Mar/April & May/June	Puget Sound Chinook	5 Chinook of natural origin; and 5 Chinook of hatchery origin	Juvenile	Capture, measure and release
2	Tributaries to the Green River within the City of Kent	March - June	Puget Sound Chinook	1 Chinook (of both natural and hatchery origin) per study stream; no more than 10 Chinook (of both natural and hatchery origin: 20 total) over entire sampling period	Juvenile	Capture, measure and release

APPENDIX A

Staff resumes

TO BE SENT

Appendix B – Study 1:
Study Plan for Monitoring the
Green River Natural Resource Area for Salmonid Utilization

Prepared by :
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INTRODUCTION

The City of Kent designed and built the Green River Natural Resource Area (GRNRA; completed in 1996) to treat stormwater and intercept flood flows in excess of 40 cfs from Mill Creek (Figure 1). However, in addition to providing flood control and water quality benefits, the GRNRA was intended to provide potential habitat for fish and wildlife. The GRNRA was designed to allow fingerling coho salmon *(Oncorhynchus kisutch*) from Mill Creek to enter the detention lagoon during winter storm events and use the lagoon as overwintering habitat (CH2MHILL 1997). It was postulated that in the spring, the juvenile coho that had entered the detention lagoon in the winter would volitionally leave the ponds and outmigrate downstream via Boeing Creek back to Mill Creek.

As part of the permit from the US Army Corps of Engineers (USCOE; Permit No. 93-4-01513), the City of Kent was required to develop and implement a salmonids monitoring plan designed to enumerate juvenile coho use of the detention lagoon. Although some limited qualitative fish sampling was completed in 1999, unforeseen problems related to riparian plantings in 1998-1999 and coincident water quality problems resulted in the City of Kent delaying start of a formal fisheries monitoring program for the GRNRA and applying for and receiving an extension from the USCOE for the completion of this work. The City of Kent has subsequently contracted with R2 Resource Consultants (R2) to develop a formal study plan to monitor salmonid utilization of the GRNRA system. This document describes the study plan developed by R2 that the City of Kent is proposing to implement for monitoring salmonid utilization of the GRNRA. The plan is organized into five sections that serve to provide important background information regarding the GRNRA system including components and operations (Section 1); the fishery resources that are in the vicinity of the GRNRA (Section 2); a description of the monitoring plan originally proposed for implementation (Section 3); a discussion of the rationale for and details of the proposed monitoring plan, including schedule (Section 4); and a list of references (Section 5).

1.1 GRNRA Components

The major components of the GRNRA facility that are relative to salmonids use include:

- The Mill Creek diversion weir (Figure 2) and a 0.6 mile long conveyance channel;

- A set of pre-settling basins that serve to remove large settleable solids, pollutants and floating materials from the inflow;

- A juvenile salmonid fish screen (constructed to NOAA Fisheries specifications circa 1996) (rotary drum screen; Figure 3) located at the south end of Weir No. 3 to prevent juvenile salmonids from entering the constructed wetland and bypassing them into the overflow channel;

- An overflow weir (Weir 3; Figure 4) and channel passes flows greater than the design treatment flows of 31 cfs into a bypass channel that connects to the detention lagoon, (*potential juvenile salmonid downstream passage portal to the detention lagoon if a) salmonids diverted at screen and into sidestream flow that enters channel, and/or b) if salmonids pass over Weir 3 at greater than design flow*);

- The detention lagoon that receives treated water from the constructed wetlands and includes riparian plantings, large woody debris, aquatic vegetation and other habitat features;

- An outlet control structure (Figure 5) consisting of a double-bayed overflow weir combined with three adjustable sluice gates *(potential juvenile salmonids ingress portal to and only egress portal from the detention lagoon*);

- An outfall channel (Figure 6) that extends for 5,900 feet from the lagoon outlet to its confluence with Mill Creek; the segment of channel paralleling West Valley Highway is referred to as "Boeing Creek"(*upstream migrating juvenile salmonids would need to pass through the adult salmonid screen*

located at the confluence of the channel and move upstream for over a mile to enter the lagoon); and

- An adult salmon screen (Figure 7) that is located at the downstream end of Boeing Creek at the confluence with Mill Creek; the screen was designed to prevent adult salmon from migrating into Boeing Creek.

Water that is diverted from Mill Creek into the constructed wetland and lagoon bypasses approximately 1.6 miles of Mill Creek. Collectively, the detention lagoon and created wetlands areas provide 63 acres of aquatic habitats.

1.2 Salmonid Access to the GRNRA

As noted above, the operation of the GRNRA facility affords two access portals to the detention lagoon for juvenile coho salmon that may be present in Mill Creek, one involving downstream migration (via the Mill Creek diversion canal and juvenile salmonids screen into the bypass channel), the other requiring upstream migration (via passage through the adult salmonid screen into Boeing Creek and moving upstream over a mile and into the lagoon). Operationally, the flows in excess of 40 cfs in Mill Creek are diverted to the treatment facility during storm events (Figure 2). The rotating drum screen (Figure 3) at the inlet to the constructed wetland serves to route fish to the detention lagoon at flows less than the 6-month exceedance flow (31 cfs) in the diversion channel. At higher flows the associated weir (Figure 4) overtops, with the potential for some fish to circumvent the drum screen and enter the constructed wetland. Regardless, all salmonids entering the diversion channel would be routed towards the detention lagoon. The outlet to the detention lagoon (Figures 5 and 6) (which would also serve as the inlet for upstream migrating salmonids) is connected to a 5,900-foot long canal that returns water to Mill Creek.

2. FISH RESOURCES IN THE VICINITY OF THE GRNRA

The City of Kent has commissioned studies to characterize the status of fishery resources, water quality conditions and general habitat features within streams and waterways

within City limits, including those in the vicinity of the GRNRA, i.e., Mill Creek. A study, commenced in 1993 was conducted in the Mill Creek, Garrison Creek and Springbrook systems and was completed in 1994 (Harza 1995). Additional work completed in 1996 (Harza 1996) and 1998 (Harza 1999) focused on streams within the Meridian Annexation Area and in 1998 four other Kent area tributaries to the Green River. During 2000, fish and habitat assessments were conducted within the Mullen Slough Subbasin (Shannon and Wilson 2002). Water quality monitoring has likewise been completed in many of these same streams (Taylor Associates 2000; URS 2000). These studies have resulted in the collection of substantial data that have proven useful to the City of Kent for planning purposes and for identifying and protecting streams that either supported or could support salmonids during certain times of the year.

Relative to the GRNRA and the Mill Creek system, Harza (1995) collected eight fish species from the combined Springbrook/Mill/Garrison (SMG) creek systems including coho salmon, cutthroat trout (*O. clarki*), rainbow trout (O. *mykiss*), three-spine stickleback (*Gasterosteus aculeatus),* pumpkinseed sunfish (*Lepomis gibbosus)* and/or bluegill (*Lepomis macrochirus),* speckled dace (*Rhinichthys osculus),* lamprey (*Lampetra sp.),* and sculpin (*Cottus sp.).* Of these, coho salmon are the primary species of concern relative to monitoring of the GRNRA. The GRNRA incorporated specific features that were thought conducive to juvenile coho overwintering survival.

Adult Chinook salmon[1] *(O. tshawytscha*) have occasionally utilized the ladder at the Black River Pumping Station (BRPS)(operated September 1 to January 31), primarily in September, but these are most likely strays from the Green River hatchery (Harza 1995). All anadromous fish entering the Mill Creek watershed must pass the BRPS. Escapement counts at the BRPS in 1994 counted 13 Chinook salmon passing the ladder of which only one was later found. There has been no documented Chinook reproduction occurring in the Mill Creek system. Harza (1995) concluded that dissolved oxygen, water temperature, and heavy metal concentrations in the SMG systems are deleterious to

[1]On March 24, 1999, the Puget Sound evolutionarily significant unit (ESU) of Chinook salmon was listed as threatened under the federal Endangered Species Act (ESA).

migrating adult salmon, particularly during the September and early-October period when Chinook salmon might be present. In contrast, towards late-October water quality generally improves when larger seasonal storms begin to occur.

Counts of adult and juvenile salmon passage were obtained from the Black River Pumping Station (H. Ahlmendinger, personal communication 2/27/02; R. Anderson, personal communication, 1/12/04). The counts suggest an average of 203 adult salmon passed upstream through the ladder from 1983 to early 2004 (range 47 to 594 fish; Table 1). Coho salmon are reported to spawn in Mill Creek up through Earthworks Park.

Sampling in the Mill Creek basin has resulted in no observations of juvenile Chinook salmon within the basin or within the downstream passage facility at the BRPS (Harza 1995). Juvenile outmigrant counts at the BRPS averaged approximately 1,266 salmonids from 1993 to 2002 (excluding 1995 to 1997; Table 2). WDFW has stocked approximately 96,000 coho fry into Mill Creek from 1981 to 1994 (Harza 1995). More recently (1995 to 2003), an average of 31,500 fry (range 0 to 70,300) have been stocked into Mill Creek near Earthworks Park (Table 3; WDFW, personal communication, November 18, 2003). Coho fry have also been stocked in other portions of the Springbrook, Panther, and Garrison Creeks. However, fry released in these locations would have to migrate downstream, then upstream in Springbrook and Mill Creek to utilize the GRNRA. In contrast, fry released near Earthworks Park could travel downstream to and into the detention lagoon via one or both of the passage portals noted above. Most of the coho fry that have been stocked into Mill Creek are derived from the Soos Creek Hatchery (Harza 1995). Harza (1995) concluded that estimated coho production of 0.01 to 0.06 smolts per square meter in the SMG watershed during 1994 were substantially lower than other systems in Puget Sound (0.1 to 1.7 smolts per square meter). The WDFW has recently changed its hatchery-outplanting program and will cease stocking hatchery salmonids into the SMG systems after 2004 to emphasize reproduction by natural origin spawners (T. Cropp, WDFW, personal communication, October 19, 2004). Thus, a reduction in the number of coho smolts outmigrating from these systems will likely occur commencing in 2005 and extending for an undetermined

number of years, until natural reproduction supplants or exceeds that provided by hatchery stocking.

3. ORIGINAL MONITORING PLAN

The original salmonid monitoring plan proposed for implementation at the GRNRA comprised a two-phased program with the first phase consisting of an initial six years of manual monitoring via trapping, with phase two consisting of installation and operation of an automated counting system (Allee 1994). The first phase of the program was to include the construction and deployment of a 10 foot by 10-foot net pen or trap nets just downstream of each of the outlet gates of the lagoon (Allee 1994; CH2M HILL 2004). It was originally proposed that these traps would be monitored daily during both the winter and spring months. During the winter, the traps would be used to monitor the number of juvenile coho moving upstream from Mill Creek into the detention lagoon. This access portal to the lagoon would presumably occur via an upstream migration of juvenile salmonids from Mill Creek into Boeing Creek and ultimately into the lagoon, a total distance of 5,900 ft. The other access portal to the lagoons exists via passage over the Mill Creek diversion structure (Figure 2), around the salmonid fish screen and into the bypass canal that leads to a set of twin culverts that connect directly to the detention lagoon (See Figure 8). CH2M HILL (2004) suggested that a separate monitoring location could be established just below the Mill Creek diversion weir (See Figure 1) to enumerate salmonid ingress into the in-flow channel during high flow events. During the spring, the traps at the lagoon outlet would serve to monitor the out-migration of coho smolts.

The original monitoring program indicated that based on the results of the first 6 years of seasonal manual monitoring, an automated counting system would then be installed (Allee 1994) at the outlet of the detention lagoon. Several electronic salmonid counting devices were recently considered for this including infrared, ultrasonic, and electromagnetic (CH2M HILL 2004). However, potential problems with debris as well as image identification led CH2M HILL (2004) to suggest the use of a digital video counting system as the primary means for enumerating fish exiting the detention pond.

All of the potential automated counting systems would require that some structural modifications be made to allow installation.

Comments provided by NMFS (1995) on the original permit application suggested its interest was on making sure the ponds were not causing an increase in mortality of juvenile coho and linked the determination of this to the quantification of numbers of salmonids entering and exiting the detention lagoon. NMFS (1995) suggested and the ACOE permit required that if the number of outmigrating juvenile coho salmon were found to be "precipitously" less than the number of coho entering the detention lagoon, than the City of Kent would be required to install a salmonid exclusion screen at the Mill Creek diversion structure. NMFS (1995) further suggested and the ACOE permit required that WDFW be contacted to help define a "tolerable" ingress-to-egress ratio.

Although the City of Kent has not conducted detailed monitoring of the GRNRA system, some limited qualitative sampling using electrofishing equipment was completed on March 25, 1999 within selected segments of the lagoon, an area near Weir 1 (that separates the constructed wetland from the lagoon) and a portion of the Mill Creek diversion channel (Gilmour 2000). Of interest, the only fish species captured included pumpkinseed and/or bluegill, and stickleback; no salmonids were collected. This is noteworthy given that a) three years had passed since the final construction and operation of the GRNRA; and b) available historical data suggests that the spring of 1999 was likely a typical year for the availability of coho juveniles from Mill Creek that might utilize the GRNRA. During 1997/1998, the count of adult salmonids passing the Black River Pumping Station Ladder (Table 1), which is an indicator of the available natural origin spawners contributing to the 1999 outmigration, was about 31 percent higher than the 1983 to 2004 average count. In contrast, the number of coho fry stocked in Mill Creek during 1998 (Table 3), which would be an indicator of the hatchery component to the 1999 outmigration, was about 84 percent of the average between 1996 and 2003. Both the natural origin and hatchery origin components contributed to the count of outmigrating smolts at the Black River Pumping Stations (Table 2), indicating that the

1999 count was slightly higher (about 6 percent) than the average of counts between 1993 and 2002.

The fact that no salmonids were captured during sampling in March 1999, a period when the likelihood of observing juvenile coho would be high, suggests that salmonids may not be using the GRNRA, or that utilization may be seasonal or very low. Further, given the recent curtailment of hatchery stocking of coho into Mill Creek, the densities of coho for at least the next 4-5 years are likely to be even lower than in the recent past. If the hypothesis of "no or low coho use of the detention pond" is true, the need for an expensive manual daily or automated monitoring system that detects all salmonid movements into and out of the GRNRA may be unwarranted. However, the one-day of sampling in March 1999 does not provide conclusive evidence to test this hypothesis. It does however suggest the need for a more careful review of one of the fundamental assumptions regarding the GRNRA, i.e., that juvenile coho would utilize the system. It is possible that due to a number of considerations, including low densities of salmonids, channel alignments, and distance from Mill Creek that the detention lagoon does not represent viable proximally situated habitat attractive to juvenile coho use. The proposed monitoring plan has been developed for implementation during the late winter and spring of 2005 and 2006 and focuses on a closer inspection of this issue.

4. PROPOSED MONITORING PLAN

The proposed monitoring plan is focused on addressing two interrelated questions:

1) Are sub-yearling juvenile salmonids using the GRNRA detention lagoon as overwintering habitat? And if so,
2) Have the resulting smolts exited the lagoon in the spring before water quality conditions become detrimental to survival?

The City of Kent believes the answers to these two questions are fundamental before committing to a more intensive and costly monitoring program such as that originally proposed.

4.1 Sampling Times

The proposed plan is for two years and consists of two short-duration intensive (using multiple sampling techniques) sampling efforts directed at providing information useful for addressing the above two questions. The first effort would occur at a time when there is the greatest likelihood of finding juvenile coho salmon within the GRNRA system. Assuming juvenile coho are using this system as high flow refugia and overwintering habitats, we would expect to find the highest densities of coho fry or yearlings in late winter/early spring in conjunction with normal storm-related run-off patterns. Based on existing information and reports (Harza 1995, 1999), we are proposing to conduct this sampling in early to mid-March.

Water quality conditions in the detention lagoon likely become unsuitable (elevated temperature and low dissolved oxygen) during the summer, and therefore the second sampling period focuses on a time when all coho smolts that are going to successfully outmigrate from the lagoons would be gone. This period corresponds to a time of water quality transition when water temperatures are increasing and dissolved oxygen concentrations are decreasing, but both are still within ranges suitable for salmonid survival. The sampling effort during this period would be the same as for the mid-March survey. Possible outcomes of the sampling could be that; 1) no salmonids were found, signaling that either; a) salmonids observed/captured in the earlier survey had successfully outmigrated as smolts; or b) consistent with not capturing any coho during the earlier survey, coho are not utilizing the lagoon as overwintering habitat, or 2) salmonids are found signaling that either: a) some of the salmonids captured or that were present but went undetected during the earlier survey were not able to find the outlet of the lagoon. We believe that in general, any coho juveniles or smolts captured at this time would likely not be able to survive in the lagoon over the warm summer months. Their capture in the lagoon at such a late date could therefore be indicative of a potential problem with smolts locating and exiting the detention lagoon outfall. This would trigger further monitoring and analysis (e.g., Fall sampling – see below) to be defined and agreed to in consultation with the Services. Counts of smolts at the BRPP suggest that the majority of coho have outmigrated from the Mill, Springbrook and Garrison creek

systems by late May (Harza 1995). We are therefore proposing to conduct the second effort in late May or early June.

During the first year of sampling, we are proposing to sample both times (March and late May/early June) regardless of whether juvenile coho are captured during the March sampling. However, in the second year, sampling in late May/early June would be contingent on capturing juvenile coho during the March surveys. Sampling both times in year one, (even if no juvenile coho are found in March), will provide a means to check the sampling efficiency in March. For example, capture of coho in late May/early June but not in March would suggest the need to modify the earlier sampling program to increase detection.

4.2 Sampling Methods and Locations

We propose to use three sampling methods during each of the survey periods: electrofishing, fyke nets, and possibly minnow traps. Broadly, the areas to be sampled include portions of the diversion channel, the detention lagoon, the outfall channel, and portions of Boeing Creek. Salmonids can only enter the constructed wetlands by passing the downstream weirs during the rare occasions when surface water elevations are extremely high in the lagoon. Consequently, we are not proposing to sample the constructed wetlands. At each survey location, water temperature, dissolved oxygen concentrations, pH, and conductivity will be determined using a Quanta Hydrolab multiparameter water quality meter.

4.2.1 Electrofishing

Electrofishing is an active capture method that is expected to have the highest likelihood of success if salmonids are present in the project area. We propose two types of electrofishing setups: barge-based and backpack. A barge-based electrofishing system is the most efficient method to cover large areas and sample waters too deep for a backpack shocker. We propose to utilize this method for sampling the detention lagoon.

The general system that will be used consists of a Coffelt VVP-15 electrofisher unit mounted in a 12-foot fiberglass Coleman Crawdad and powered by a 5000 W, 240-Volt AC gasoline-powered generator. The electrofisher will be operated in a straight DC configuration with settings consistent with guidelines established by the WDFW guidelines (WDFW 1998). A mobile electrode system (Vincent 1971) using two 30 cm stainless steel balls suspended from booms as cathodes and a 24 cm aluminum anode attached to an electrical cable will be used to produce straight DC voltages and electrotaxis. Two anodes may be used to increase overall coverage. Each anode includes 15 feet of insulated cable for either hand-held passes or tossing and retrieval of the anode. An electrically isolated live car will be carried in the barge. Three biologists will operate the barge-based system: one person operating the electrofisher unit and pushing the barge, one person directing the anode, and one person netting stunned fish.

For the diversion channel, where depths are likely to be less than 3 feet deep, the channel relatively narrow, and access by a barge-based system difficult, we propose to utilize a Smith-Root Model-12 backpack electrofisher. A three-person team will conduct the sampling with one person carrying the electrofisher and electrodes (ring anode, rat-tail cathode), one person netting stunned fish, and one person carrying a bucket for captured fish.

A 2-day intensive electrofishing effort is proposed during the month of March and again in late May/early June. One-day of effort will be expended in the lagoon using the barge-based system. Areas to be targeted for sampling include shoreline areas containing vegetative cover and large woody debris structures. Sampling will be conducted primarily during daylight hours, although some of the shoreline areas will be sampled at night as well. One-day of effort will be expended in the diversion and outflow channels using the backpack system. Start and stop times will be recorded during both electrofishing efforts to allow computation of catch per unit effort (CPUE) estimates.

4.2.2 Fyke Nets and Beach Seining

In addition to active capture electrofishing techniques, we are proposing to deploy and monitor a fyke net within the detention lagoon just north of the location where twin 9-foot culverts deliver water from the Mill Creek bypass canal (Figures 8 to 10). All salmonids that might be diverted from Mill Creek would pass through these culverts, except those that travel upstream through the outflow channel. This location is strategic for capturing fish passing through the culverts or traveling north or south along the eastern edge of the lagoon. We will also evaluate the utility of deploying a second fyke net just downstream from the Mill Creek diversion weir. A net at this location would capture salmonids just entering the diversion canal. Deployment would be coincident with the first net; the net would be checked daily for salmonid captures. The general construction of a fyke net consists a set of incrementally-sized hoops that hold a tunnel-shaped net open (Figure 7)(AFS 1999). A fyke net relies on the active movement of salmonids to result in capture; consequently it is considered a passive capture method. Wings and a lead at the entrance to the trap guide salmonids to the interior of the net. Two hoops include "throats" that make it difficult for salmonids to exit the trap. The fyke net ends at a live pen for holding salmonids until they can be processed. We propose to deploy the net(s) for five consecutive days; initial deployment will occur on the first day of sampling. The fyke net will be checked at least twice daily, with immediate removal and processing of trapped fish from the live car.

In addition to the fyke nets, beach seining may be conducted along the eastern shoreline areas proximal to the twin-culvert inlets and along selected western shoreline areas.

4.2.3 Minnow Traps

Supplemental sampling may be conducted using Gee Type minnow traps (mesh 0.25 inch) baited with commercial salmon eggs or other bait products. Two strings of 5 traps connected at about 20-foot intervals to a weighted line will be deployed in shallow water near shoreline cover or large woody debris. Exact locations will be determined in the

field and may change depending upon capture success. We propose to deploy minnow traps during the same five-day period as the fyke net(s) and to check them and process fish on a twice-daily basis.

4.2.4 Processing of Captured Fish

Captured fish will be processed according the following procedure:

- All captured fish will be identified to species
- Non-salmonid fish will be enumerated (approximate lengths estimated) and released
- All salmonids will be anesthetized in a buffered solution of MS-222, measured for total length (mm) and weight (gm), fin clipped (pectoral or pelvic), and released within 100 m of capture site.

4.2.5 Schedule

We propose to conduct surveys over two 5 -day periods during March and late May/early June of 2005 and during March and possibly late May/early June (if coho captured in March) 2006. The fyke net and minnow traps will be deployed at the beginning of the survey period. As indicated previously, electrofishing will occur over a 2-3 day period with 1 day allocated for the detention lagoon and 1-2 days for diversion and outfall channels.

If NO salmonids found in September survey, this suggests summer lagoon conditions are likely fatal to salmonids. The City will then consult with the Services about possible measures to be implemented to either improve the egress of salmonids from or prevent salmonid use of the detention lagoon.

4.2.6 Report and Meetings

A short letter report that describes the results of each sampling effort will be prepared and submitted to the Services within one month following completion of each survey.

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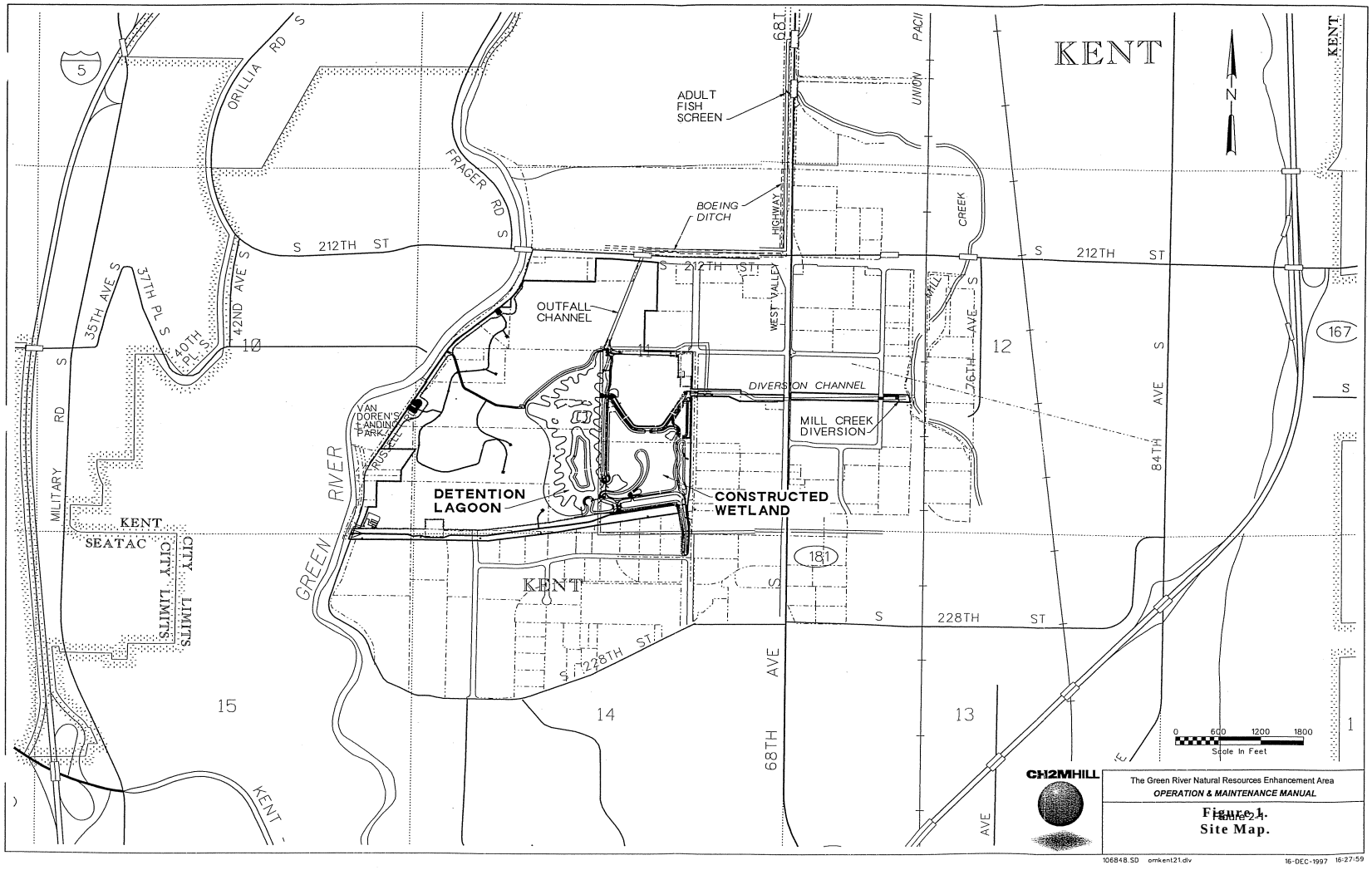
KENT
ADULT FISH SCREEN
BOEING DITCH
OUTFALL CHANNEL
DIVERSION CHANNEL
MILL CREEK DIVERSION
DETENTION LAGOON
CONSTRUCTED WETLAND
VAN DOREN'S LANDING PARK
GREEN RIVER
KENT SEATAC
CITY LIMITS
S 212TH ST
S 228TH ST
68TH AVE S
84TH AVE S
76TH AVE S
MILITARY RD S
ORILLIA RD S
FRAGER RD S
35TH AVE S
37TH PL S
40TH PL S
42ND AVE S
WEST VALLEY HIGHWAY
MILL CREEK
UNION PACIFIC
KENT-
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CH2MHILL
The Green River Natural Resources Enhancement Area
OPERATION & MAINTENANCE MANUAL
Figure 1.
Site Map.
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Figure 2. Stormwater diversion weir at the mouth of the diversion near the confluence with Mill Creek.

Omitted

Figure 3. Drum screen located at the downstream end of the diversion channel.

Omitted

Figure 4. Overflow weir at the downstream end of the diversion channel (on right). The high flow bypass channel is to the left.

Omitted

Figure 5. Outfall gate structure at north end of the lagoon.

Figure 6. Outfall channel leading to Boeing Creek.

Omitted

Figure 7. Adult salmon screen (on right) located at lower end of Boeing Creek at confluence with Mill Creek (on left).

Figure 8. Twin 9-foot culverts at the downstream end of the high flow bypass channel.

Omitted

Figure 9. View of lower end of detention lagoon just north of the 9-foot twin culverts at the end of the bypass channel. This area represents proposed fyke net location.

Omitted

Figure 10. Drawing of a fyke net. We propose to modify this with a holding pen at the cod-end and lead at the entrance. (From Hubert 1982).

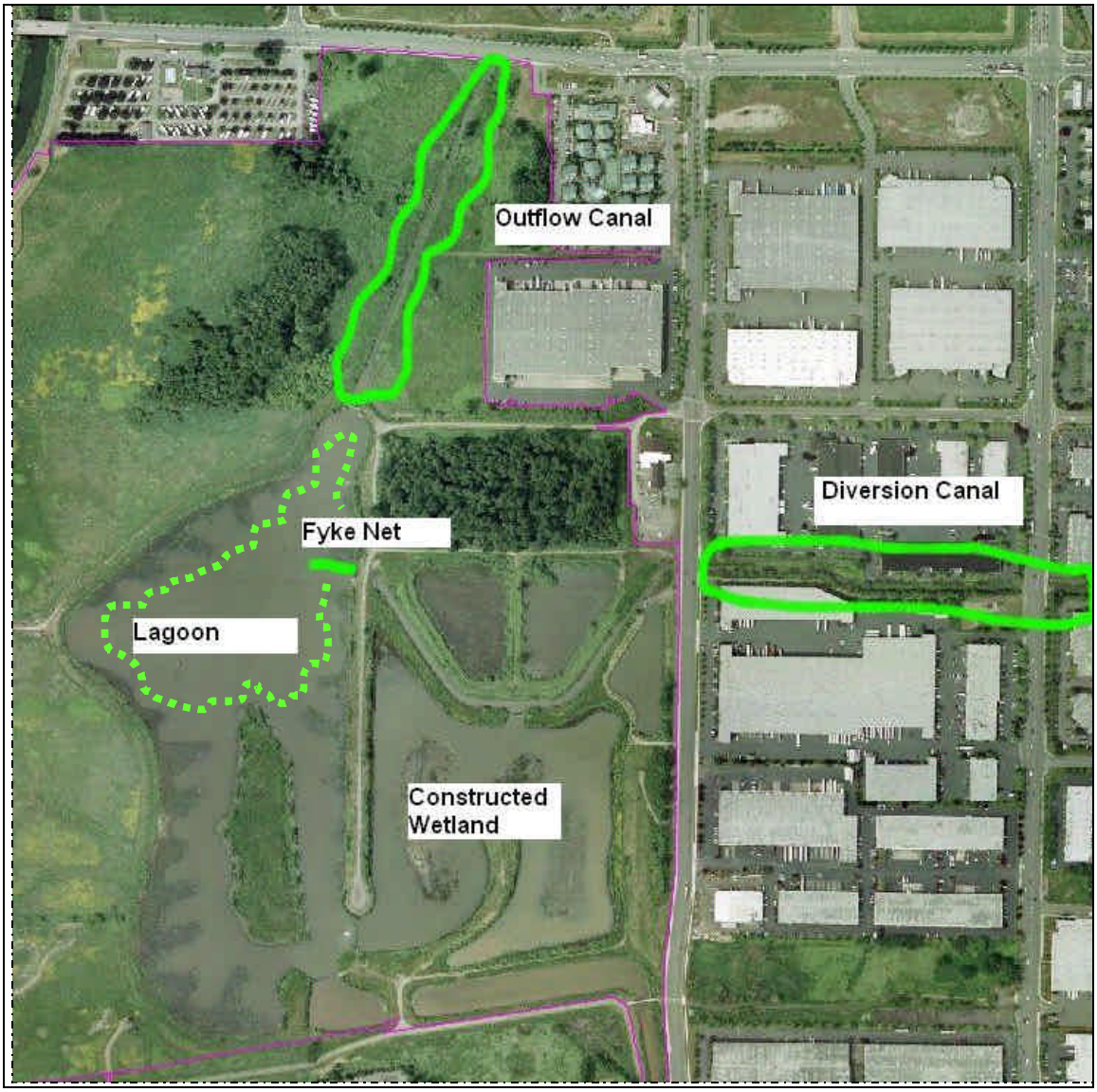

Figure 11. Aerial photo of the Green River Natural Resource Area and proposed sampling locations (outlined in green). Sampling via electrofishing will also be conducted in the Lagoon; general area to be sampled outlined in dashed green line.

Table 1. Counts of adult salmon at the Black River Pumping Station 1983 to early-2004.

Year	Adult Count
1983-1984	155
1984-1985	119
1985-1986	47
1986-1987	82
1987-1988	166
1988-1989	95
1989-1990	77
1990-1991	69
1991-1992	107
1992-1993	291
1993-1994	120
1994-1995	268
1995-1996	355
1996-1997	206
1997-1998	265
1998-1999	84
1999-2000	395
2000-2001	463
2001-2002	594
2002-2003	114
2003-2004	191
Mean	203

Table 2. Counts of downstream juvenile salmon migrants at the Black River Pumping Station. The 1993 and 1994 counts were conducted manually while the 1997 to 2002 counts utilized an automated counter. The 1997 counts are considered inaccurate due to fine-tuning and calibration of the newly installed automatic counter.

Year	Juvenile Count
1993	1322
1994	1456
1997	774
1998	146
1999	1340
2000	1773
2001	1075
2002	1751
Mean (excluding 1997)	1266

Table 3. Number of coho fry stocked into Mill Creek by WDFW from 1995 to 2003.

Year	Number of Stocked Fry
1995	11077
1996	9738
1997	10044
1998	26313
1999	42828
2000	0
2001	70329
2002	45695
2003	67080
Mean	31456

APPENDIX C – Study 2

Scope of Work

Fish and Habitat Surveys of Selected Stream Within the City of Kent Related to the Critical Areas Ordinance

SCOPE OF WORK

FISH AND HABITAT SURVEYS OF SELECTED STREAMS WITHIN THE CITY OF KENT RELATED TO THE CRITICAL AREAS ORDINANCE

R2 Resource Consultants
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Redmond, Washington 98052

INTRODUCTION

SCOPE OF WORK

R2 shall conduct fish and aquatic habitat surveys in selected streams and waterways within the Kent city limits. The stream locations and methods to be used are as described below.

Background and Rationale:

The City of Kent has commissioned a number of fisheries related studies to among other things characterize the status of fishery resources, water quality conditions and general habitat features within streams and waterways within its' city limits. The initial study commenced in1993 and was conducted in the Mill Creek, Garrison Creek and Springbrook systems and was completed in 1995 (Harza 1995). Additional work completed in 1996 (Harza 1996) and 1998 (Harza 1999) focused on streams within the Meridian Annexation Area (during both survey times) and as well in 1998 four other Kent area tributaries to the Green River. Most recently (2000), fish and habitat assessments were conducted within the Mullen Slough Subbasin (Shannon and Wilson 2002). Water quality monitoring has likewise been completed in many of these same streams (Taylor Associates 2000; URS 2000).

These studies have resulted in the collection of substantial data that have proven useful to the City of Kent for planning purposes and for identifying and protecting streams that either supported or could support salmonid fish during certain times of the year. The revisions to the Critical Areas Ordinance and Stream Type Classifications proposed by the City of Kent have implications relative to the degree of stream protection, primarily a function of the width of buffer zones. The City of Kent has therefore requested that R2 conduct fish and aquatic

ecological surveys within streams not previously surveyed and as well supplemental surveys within certain streams previously sampled. These latter streams represent some of the more important salmonid bearing streams within the city limits and for which repeated sampling would provide an index of abundance from which to base and compare survey results of the unsampled sites.

Approach

Using a GIS based map of stream Typing Classifications provided by the City of Kent, R2 identified locations of streams previously sampled (based on previous studies) as well as streams and waterways for which no information has been collected. These latter streams are presently classified as "Unknown" relative to fish species presence/absence or habitat quality and are the focus of this study. Based on discussions with the City of Kent, R2 has identified 17 new sites to be surveyed. In addition, R2 is proposing to re-sample 11 "index" streams previously surveyed in 1996 and 1999 as a means to update their fish presence/absence information to the proposed CAO and stream Type Classification. R2 believes that the sampling of these 11 sites should provide information useful for inferring fish use to other previously measured sites. Table 1 contains a listing of all sites R2 is proposing to sample separated into two groups corresponding to "new" and " old" (i.e. previously sampled) sites.

Table 1. Locations of streams and channels with the City of Kent proposed for sampling in 2005; identification of streams and channels based on reviews of previous studies (see References) and on GIS map coverage and Stream Type Classifications provided by the City of Kent.

Number	Stream (New/Old)	Location - Drainage	Existing Type Classification
1	East Fork Soosette (New)	East of 144 Ave. SE	Type 4 – but not sampled
2	Trib to W.Fork Soosette (New)	North of SE 288 St.	Type 4 – but not sampled
3	Middle Fork Upper Mill Creek (New)	Traverses 108 Ave SE	Unknown – not sampled
4	North Fork Upper Mill Creek (New)	From State Rte 516 to below 108 Ave SE	Type 5 – but not sampled
5	North Fork Upper Mill	Segment from SE	Unknown – not

	Creek (New)(above culvert)	256th to SE 248 St.	sampled
6	Trib to Green River (New)	Just south of SE 277 St	Unknown – not sampled
7	Lower Mill Creek (Auburn) (New)	About ½ mile of segment extending from SR 181 to mouth with the Green River.	Type 3 – but only segment above this reach has been sampled.
8	Trib to Mullen Slough (New)	About ½ mile segment extending from SW Corner Section 26 to just below Kent-Kangley Road	Unknown – not sampled
9	Lower Garrison Creek (New)	About 2/3 mile section extending south from Valley Freeway to small pond adjacent to 84th Ave S.	Unknown – not sampled
10	Benson Fork Garrison Creek (lower reach)(New)	From channel split in SE portion of Section 18 to 98th Ave.	Type 4 - but not sampled
11	Middle Fork Garrison Creek (middle reach)(New)	Section extending northwesterly from Benson Road to 98th Ave.	Type 3 – but not sampled
12	Trib to Garrison Creek (New)	Originates just above intersection of SE 208 St and Valley	Unknown – not sampled

		Highway and extends northeasterly	
13	Trib to Lower Mill Creek (New)	Extends parallel to S 212 St originating just west of East Valley Hwy and extending west to junction with Lower Mill Creek	Unknown – not sampled
14	Boeing Creek (New)	From S 212 St east to 68 Ave S and then north to SE 208 St.	Type 3 – but not sampled
15	West Trib to Lower Mill Creek (New)	About 1200 ft segment extending from West Valley Hwy to confluence with L. Mill Creek	Unknown – not sampled
16	South Trib (# 1) to Lower Mill Creek (New)	About 2/3 mile segment extending from mid-upper portion of Section 01 north to confluence with L. Mill Creek near SE 192 St. (enters just downstream from West Trib.	Unknown – not sampled
17	South Trib (# 2) to Lower Mill Creek (New)	About 2/3 mile segment extending from just below SE 192 St. north to confluence with	Unknown – not sampled

		Lower Mill Creek just below its confluence with Lower Springbrook Creek.	
18	Meridian Valley Creek (Old)	Reach runs diagonal through Section 22 from SE 240 St to SE 256 St.	Type 3 - Repeat survey to document fish use since earlier surveys; indicator for other Meridian streams
19	West Fork Soosette Creek (Old)	Site just above 132 Ave SE within upper NE portion of Section 33	Type 3 - Repeat of survey to document fish use since earlier surveys; indicator for other Soosette Creek streams
20	Upper Mill Creek (Old)	Site just below Canyon Drive just before the stream channel swings directly north	Type 3 - Repeat of survey to document fish use since earlier surveys; indicator for other Upper Mill Creek streams
21	Middle Fork Garrison Creek (Old)	Site located near 218th St. Bridge	Type 3 – Repeat survey to document fish use since earlier surveys; indicator for other Garrison and Benson Creek systems
22	Lower Mill Creek (Old)	Site just above SE 192 St. on main channel	Type 3 – Repeat survey to document fish use since earlier surveys; indicator for other LMC streams

23	Lower Springbrook Creek (Old)	Site on bend just west of 80 PL South.	Type 2 - Repeat survey to document fish use since earlier surveys; indicator for other Springbrook streams.
24	Clark Lake Outlet (Old)	About ½ mile of stream extending from outlet to near end of Section 16	Type 4 – Repeat survey to document fish use.
25	Lower Midway Creek (Old)	About ½ mile segment extending midway up and down from SE 240th St.	Type 4 – Repeat portion of earlier survey
26	S. Tributary of Soosette Creek (Old)	About 1200 ft segment just above wetlands in middle of Section 28	Type 4 – Repeat portion of earlier survey
27	N. Tributary West Fork Soosette Creek (Old)	About 1200 ft segment just above confluence with NW Trib. of West Frk Soosette Creek	Type 3 – Repeat of portion of earlier survey
28	N.W. Tributary of West Fork Soosette Creek (Old)	About 1200 ft segment just above confluence with N Trib. of West Frk Soosette Creek	Type 3 – Repeat of portion of earlier survey

Study Site Selection –Final Study Design

Final selection of study sites and final study design shall be made in consultation with the City of Kent. Land ownership maps will be reviewed and to the extent possible, initial selection of sites will focus on stream segments accessible to the public. R2 believes a number of the candidate study sites will only be accessible through private property. For costing purposes R2 has assumed that the City of Kent would take the lead in gaining permission to

access these streams. In the event access permission cannot be obtained, to the extent possible and practical, R2 shall adjust the location of proposed sites. In some cases, it may be necessary to simply omit sites if substitute locations cannot be found.

Data Collection and Analysis

R2 proposes to conduct the fish and aquatic habitat surveys using methods consistent with those applied during earlier samplings. The surveys will consist of three components – a) Habitat Surveys; b) Fish Sampling; and c) Benthic Macroinvertebrate Sampling. The collection of benthic macroinvertebrate samples will be limited to those streams whose physical and hydraulic habitat characteristics are conducive to salmonid production and/or salmonids were found during sampling. Details of each of these components are described below.

Habitat Surveys - While the surveys will focus on sampling for fish, in particular salmonids, R2 is proposing to conduct habitat surveys in each of the sampled streams. For this, R2 is proposing to use the Urban Stream Baseline Assessment Method (USBEM) that was developed by R2 for the Tri-County Urban Issues ESA Study (R2 et al. 2000). The method can be applied relatively quickly and is focused on evaluating those factors that are good indicators of salmonid habitat use and suitability. It was specifically developed for use on streams within urbanized or urbanizing settings such as exist within the Kent city limits. The method is applied in two-phases with Phase 1 – a Pre-Field Assessment that results in a preliminary determination of salmonid use potential, and Phase 2 – Field Assessment that includes measurement of a number of habitat parameters including riparian condition, substrate composition, embeddedness,, bank condition, passage conditions, pool frequency, large woody debris, and water temperature. Benthic invertebrates are included as a component in USBEM as a means for deriving Benthic – Index of Biotic Integrity (B-IBI) scores for comparison with other Puget Sound systems. R2 proposes to complete the Phase 1 assessment in February-March and the field surveys in March-April in conjunction with the fish surveys.

Fish Sampling - R2 is proposing a fish sampling approach similar to that used in previous surveys (Harza 1996). For this, a two-tiered approach would be used with Tier 1 surveys being conducted in the spring (March-April) and focused on juvenile salmonid usage, and Tier 2 surveys completed in the fall and focused on spawning. The general methods to be applied during these surveys are described below.

- Juvenile Salmonid Surveys (spring) – Juvenile salmonid presence or absence in each of the streams shall be evaluated by R2 during March - April (period when juvenile fish should be present in these systems) primarily by the use of electrofishing techniques. For this, a representative segment of each stream (reach lengths variable depending on channel widths; minimum length of 100 ft shall be surveyed) shall be electrofished in an upstream direction (where conditions permit) using a Smith-Root Mark VI backpack electrofishing unit (for small streams) or a Coffelt Manufacturing Inc. VVP-15 variable voltage pulsator. Straight DC voltages shall be used to produce electrotaxis, with settings consistent with guidelines established by the Washington Department of Fish and Wildlife (WDFW) guidelines (WDFW 1998). Supplemental seining may be completed if problems are encountered with electrofishing (e.g. water depths too deep).

  For all New sites, when salmonids are captured, R2 shall extend the sampling effort upstream until a) no salmonids are captured (marking the upstream extent of salmonid usage), b) an obstacle or feature is encountered that would prevent upstream passage of salmonids (marking the upstream extent of salmonid passage), or c) access becomes restricted due to private land ownership. For this, R2's costs assume an additional 4 hours of sampling will be needed for each New site.

  All salmonids captured shall be identified to species, hatchery marks noted, weighed (nearest g) and measured (nearest mm) and released within their capture site. Other fish species shall be identified to species, a subset (minimum 10 fish) weighed and measured, and released.

- Salmonid Spawning Surveys (fall) – R2 shall conduct bi-weekly spawning surveys over a three month period (October – December: 6 total surveys) within selected portions of those surveyed streams possessing suitable spawning habitats (as identified from the habitat surveys). Results of previous studies suggest spawning is limited in streams within the City of Kent and therefore R2's costs are based on completing a total of six 1-day surveys at selected sites. Final selection of streams to be surveyed shall be made in consultation with City of Kent personnel (M. Knox).

Benthic Invertebrate Sampling – During the habitat surveys, R2 shall collect and retain benthic macroinvertebrate (BMI) samples from each of the streams for which conditions

appear conducive for juvenile salmonid rearing. The collection of samples shall be made using either a Hess sampler or D net kick sampler following WDOE protocols (a single composite of three samples per site). The samples shall be preserved in 70% ethanol and returned to R2. For cost purposes, we have assumed the BMI samples would be collected from half of the new (about 8 samples) and all of the old sites (11 samples) – total = 19 samples. R2 also proposes to subsequently analyze these samples to the lowest practical taxonomic level (Family or Genus level) and compute appropriate metrics, including the B-IBI. This will enable comparison of these values to other Puget Sound systems.

Schedule – R2 proposes to complete this work in accordance with the following schedule:

- Meeting to Finalize Study Plan with City of Kent – February 25, 2005
- Apply for Collection Permits (applications already submitted)
- Complete Phase 1 habitat surveys (USBEM) – February-March
- Conduct Phase 2 habitat surveys, juvenile fish surveys and BMI collection – March – April
- Laboratory analysis BMI – May-June
- Conduct spawning surveys – October – November
- Draft Report submitted to City of Kent – on or before December 31, 2005
- Final Report – January 31, 2006

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